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Agency

Air and Radiation
Clean Air Markets Division
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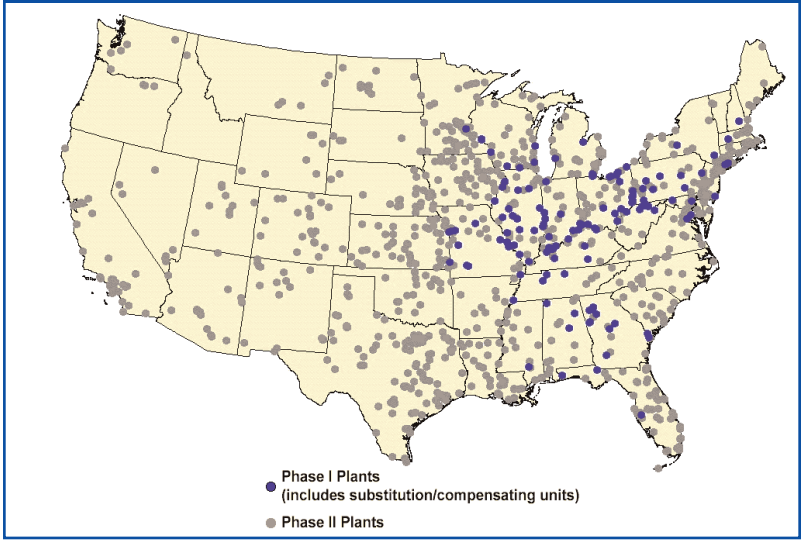
www.epa.gov/airmarkets

EPA's Acid Rain Program: Results of Phase I Outlook for Phase II

This factsheet discusses the results of and outlook for EPA's Acid Rain Program. For information on acid rain and its effects, see <www.epa.gov/airmarkets/acidrain>.

EPA's Acid Rain Program was established under Title IV of the 1990 Clean Air Act (CAA) Amendments to address the long-range transport and deposition of sulfur dioxide (SO_2) and nitrogen oxides (NO_x)—emissions produced by fossil fuel combustion that adversely affect air quality, the environment, and human health. The Acid Rain Program sets ambitious goals for reducing and capping SO_2 emissions and for setting NO_x emission rate limits for electric utility power plants, the primary source of SO_2 and a major source of NO_X. During Phase I of the program for SO_2 (1995-1999), emissions were reduced about 50 percent from 1990 levels from the 263 highest-emitting sources, primarily in the eastern half of the United States. Rather than setting a national limit on NO_x emissions, Title IV limits the amount of NO_x emitted for each unit of fuel consumed at each plant (lb of NO_x/mm Btu of heat input). During Phase I of the program for NO_x (1996-1999), emissions were reduced about 32 percent from 1990 levels. Phase II for both SO_2 and NO_X (2000 forward) affects more than 2,200 boilers and turbines and includes all new sources. (See Figure 1.)

Figure 1. Affected Sources Under the Acid Rain Program



The SO_2 portion of the Acid Rain Program gives each power plant a certain number of "allowances" each year. An allowance authorizes the emission of 1 ton of SO_2. By 2010, EPA will reduce SO_2 levels from all utility plants by 50 percent from 1980 levels by capping SO_2 allowances at 8.95 million tons annually. Allowances can be bought, sold, or saved for future use. New plants must obtain allowances from other plants, the market, or the annual SO_2 allowance auction. Since plants may sell excess allowances, they have an economic incentive to reduce emissions. Each individual company decides how to reduce its SO_2 emissions. This compliance flexibility and trading of allowances has reduced compliance costs more than 75 percent from initial estimates.

Results of Phase I: SO_2 (1995-1999)

Throughout Phase I, utilities generally reduced emissions below the level of allowances allocated under the CAA, allowing human health benefits and environmental recovery to begin sooner.

- In Phase I (1995-1999), the Acid Rain Program achieved 100 percent compliance. Reductions were achieved on time and were greater than expected. (See Figure 2.)
- SO_2 data from 1999 indicate both Phase I and II sources further reduced emissions in the expectation of tighter controls in Phase II. (See Figure 2.)
- The greatest SO_2 emission reductions were achieved in the highest-emitting states (Midwest). (See Figure 3.)
- SO_2 emission reductions have produced measurable environmental improvements. Wet sulfate (SO_4) deposition levels (a primary component of acid rain) dropped as much as 25 percent over a large area of the eastern United States. This unprecedented reduction was measured by the 200-plus-station National Atmospheric Deposition Program/National Trends Network (NADP/NTN) and the rural 70-plus-station Clean Air Status and Trends Network (CASTNet). (See Figure 4.)
- Improvements also occurred in regional air quality. In the early 1990s, ambient SO_4 concentrations (the largest component of health-impacting fine particulate matter) were high throughout much of the eastern United States. (See Figure 5.)

Figure 2. SO_2 Emissions from Title IV Sources

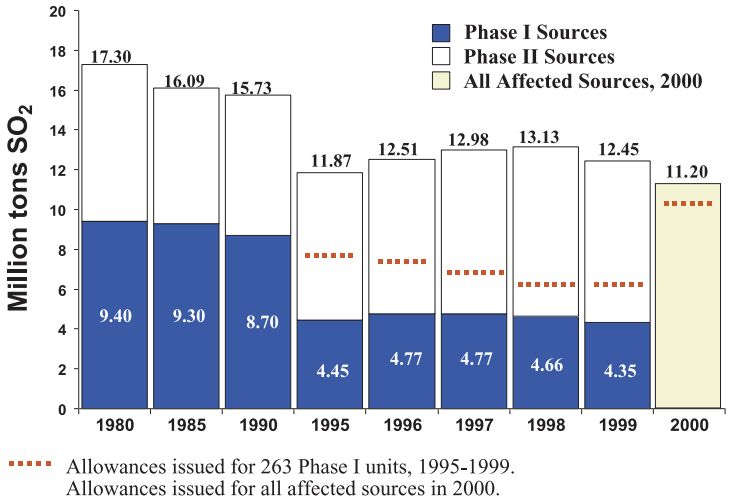


Figure 3. Total Utility SO_2: 1980, 1990, 1995-1999 Phase I Average

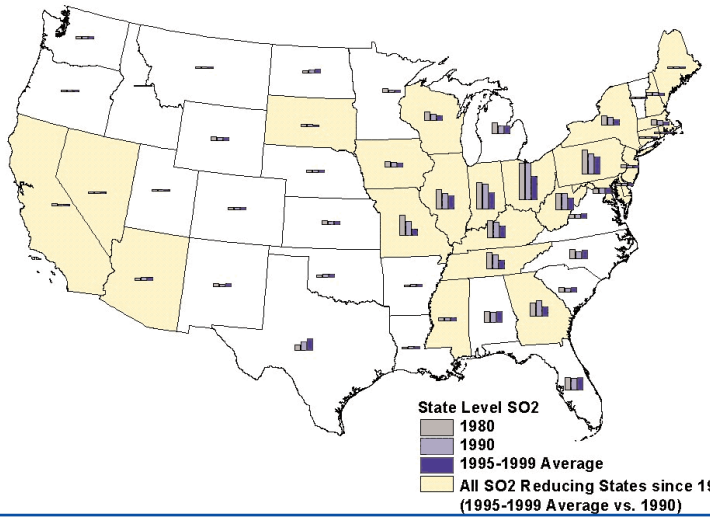


Figure 4. Wet Sulfate Deposition Reduced (kg/ha)

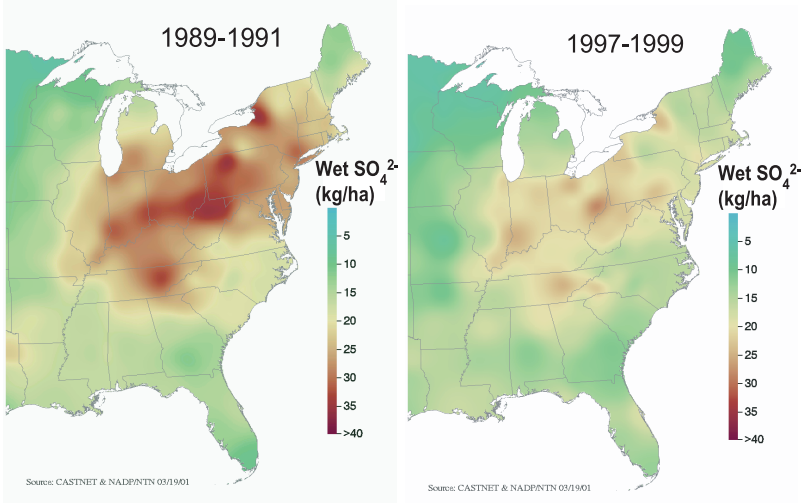


Figure 5. Ambient Sulfate Concentrations Reduced (µg/m³)

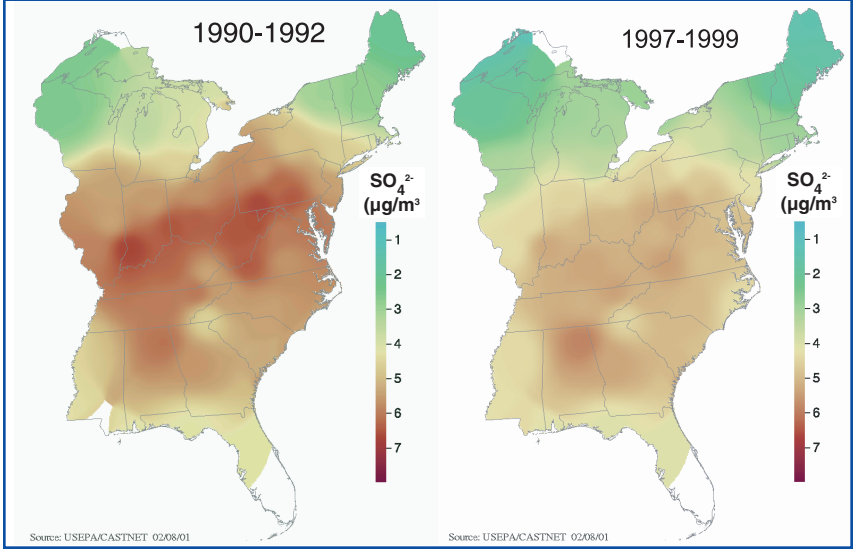


Figure 6. Projected SO_2 Emission Reductions from Power Generation Under the Acid Rain Program

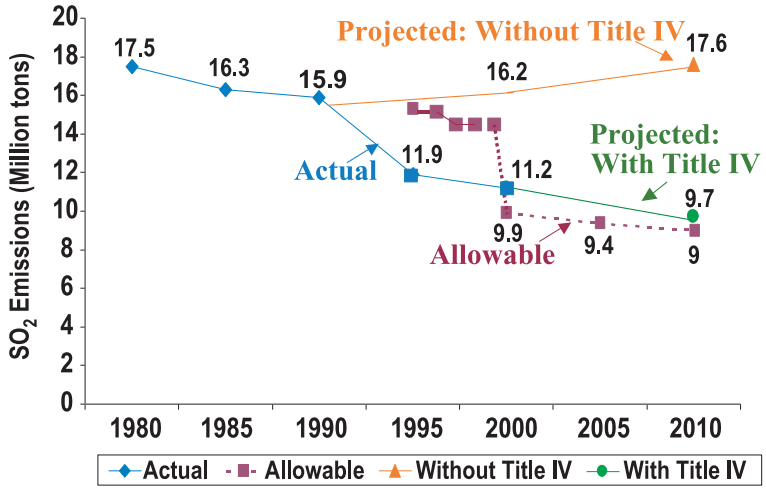
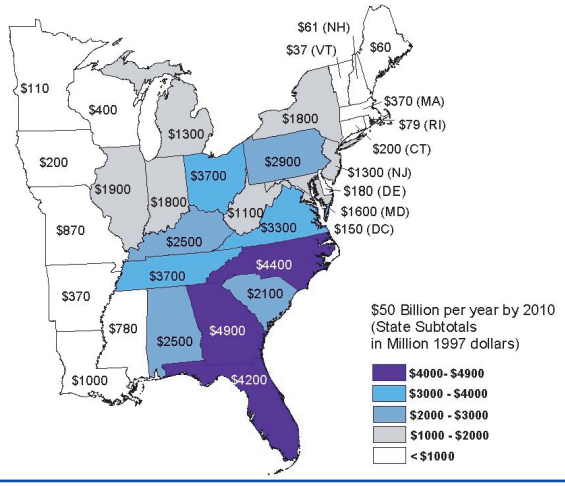


Figure 7. $50 Billion in Health Benefits from Acid Rain Program SO_2 Reductions



- By the late 1990s, however, significant reductions in SO_2 emissions under Phase I resulted in lower SO_4 concentrations where they had been highest, as measured by CASTNet. (See Figure 5.)

Outlook for Phase II: SO_2

- By 2010, SO_2 allowance allocations to electric utilities will drop to less than 9 million tons annually, half of 1980 utility emission levels. Because electricity production generates most of the SO_2 emissions in the United States, this represents a 40 percent reduction in total SO_2 emissions from 1980 levels. (See Figure 6.)
- By reducing emissions below the allowable level in Phase I, companies saved (or banked) these unused allowances to help meet the more stringent Phase II limits, which took effect in 2000. (See Figure 6.)
- EPA expects that the use of saved allowances will result in SO_2 emissions higher than allowance allocations during Phase II. This is both expected and allowed, due to banking of early reductions achieved in Phase I. (See Figure 6.)
- In Phase II, total SO_2 emissions will be less than in Phase I, and after 2010, allowable and actual SO_2 emission levels are expected to converge, achieving a 50 percent reduction in utility emissions from 1980. (See Figure 6.)
- Achieving greater SO_2 emission reductions earlier than expected has lowered risks to human health.
- By 2010, total health benefits under the Acid Rain Program are estimated to reach more than $50 billion dollars annually. (See Figure 7.)

Results of Phase I: NO_x (1996-1999)

- Many states have reduced NO_x emissions since 1990. (See Figure 8.) Because annual NO_x emissions are not capped, as electricity generation rises, year-round NO_x emissions are expected to increase gradually later this decade.
- The Program's greatest NO_x reductions occurred in the eastern United States. (See Figure 8.)
- Phase I sources achieved 100 percent compliance. (See Figure 9.)
- From 1990 to 1999, the average NO_x emission rate for Phase I sources fell from 0.70 to 0.40 lb/mmBtu (43 percent). (Not shown in a figure.)
- Since 1990, Phase I sources have reduced annual NO_x emissions by more than 420,000 tons (32 percent). (See Figure 9.)
- Under the rate-based system, allowable emissions rose as utilization rose. (See Figure 9.)

Outlook for Phase II: NO_x

- In 2000, NO_x emissions were approximately 1.5 million tons lower than 1990 levels. By 2010, NO_x emissions are expected to be slightly higher than 2000 levels. (See Figure 10.)
- By 2010, the multistate NO_X reduction effort (NO_x SIP Call) is expected to reduce summertime NO_x emissions in the eastern United States by nearly 1 million tons from 2000 levels. (See Figure 10.)
- Together, by 2010, the Acid Rain Program and the NO_x SIP Call should reduce total NO_x emissions approximately:
  - 2.4 million tons below 1990 levels.
  - 4.5 million tons below what emissions would have been without the two programs. (See Figure 10.)

For more information about the Acid Rain Program, see <www.epa.gov/airmarkets/arp>.

Figure 8. Total Utility NO_x: 1990 vs. 1996-1999 Phase I Average

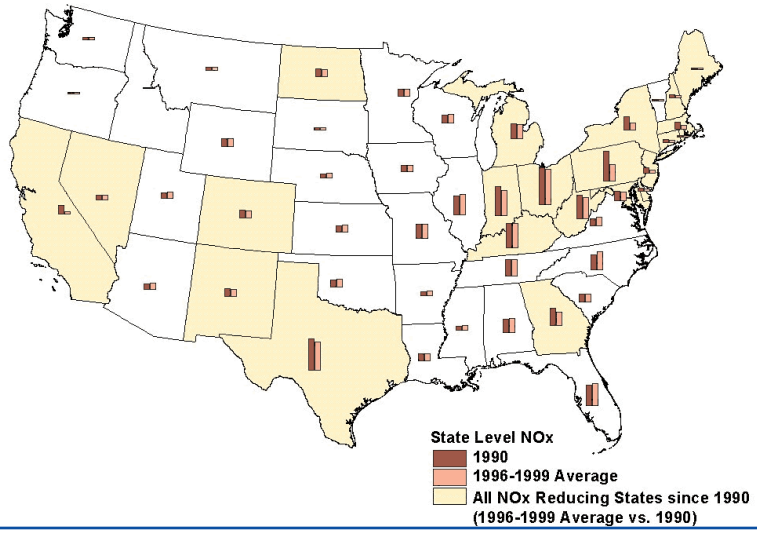


Figure 9. Phase I NO_x Emissions

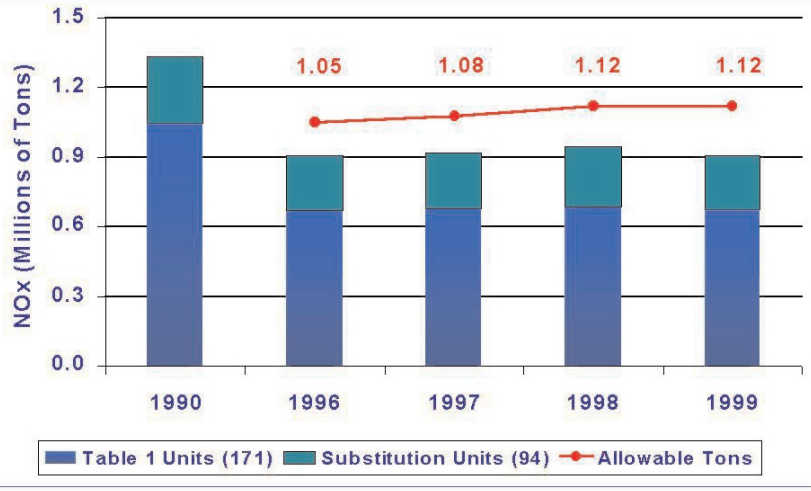


Figure 10. Projected NO_x Emission Reductions from Power Generation Under the Acid Rain Program